Introduction to Logic (Fall 2000)

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1 Course Description

Logic, parts of which form a branch of mathematics and parts of which form a branch of philosophy, is the science of reasoning. This course is a general introduction to first-order logic, or FOL as it is called in *LPL*. FOL is a ubiquitous and important tool used in many fields (e.g., artificial intelligence, cognitive and computer science, engineering, robotics, etc.). Though this course is self-contained, it's designed to be a stepping-stone to intermediate logic, which is covered in *Computability and Logic* at Rensselaer. The combination of *Introduction to Logic* and *Computability and Logic* will give you a solid background which will serve you well in many fields and careers. Advanced level logic is offered through graduate seminars and independent studies (e.g., the graduate course *Logic and Artificial Intelligence*).

Introduction to Logic is a key course in the *Minds & Machines Laboratory and Program* and is specifically used in a number of research projects in *Minds & Machines Laboratory*, about which you will be hearing more. For information on this program, see

- `http://www.rpi.edu/dept/ppcs/MM/mm.uc.html`

This is a four credit course. The fourth contact hour comes via lab time, the nature of which I will make clear when we crack into the software. Your laptop is going to come in handy!

The web is a crucial component of this course. See and get comfortable with the *LPL* web site for the course as soon as possible.

The objectives of the course are the following four.

1. Students will understand and remember the basic machinery of elementary logic, especially as this machinery intersects with cognitive and computer science and robotics, and so will be prepared to use this knowledge in the future in both academic and non-academic situations.

2. Students will acquire the ability to construct proofs in first-order logic, and thereby lay a foundation for future mathematical problem-solving.

3. Students will acquire the ability to solve logic problems that require transfer back and forth between first-order logic and English, e.g., problems of the sort that appear in the Analytical Reasoning sections of the LSAT and GRE, and that appear in the psychology of reasoning (a sub-discipline in psychology).

4. Students will come to understand logic in the context of jobs in information technology, especially in the context of those areas of study covered by the *Minds & Machines Program* and *Minds & Machines Lab*.

2 About the Professor

I've been studying and teaching logic since 1976, but, alas, have yet to qualify as a full-fledged Vulcan[1] I received the PhD from Brown University in 1987; immediately thereafter I came to Rensselaer. I specialize in logic (and philosophy) as it intersects with Artificial Intelligence (AI) and cognitive and computer science. I'm the director of the *Minds & Machines Program* and the *Minds & Machines Lab*.

3 Texts

We have one required text, *Logic, Proof, and Logic* (*LPL*), by Barwise & Etchemendy, from which the readings in the schedule below come. This book comes with a number of different courseware systems.

4 Schedule

Date	Topic	Reading
August 28	General Orientation	
August 31	Why Learn Logic?	take notes
September 4	No Class (Labor Day)	
September 7	Diagnostic Pre-Test, Puzzles	take notes
September 11	Atomic Sentences	I.1
September 14	Atomic Sentences	I.1
September 18	Logic of Atomic Sentences	I.2
September 21	Logic of Atomic Sentences	I.2
September 25	Boolean Connectives	I.3
September 28	Logic of Boolean Connectives	I.4
October 2	Methods of Proof	I.5
October 5	Formal Proofs	I.6
October 9	No Class (midterm break)	
October 12	Conditionals	I.7
October 16	Logic of Conditionals	I.8
October 19	Class used for **Takehome Midterm**	
October 23	Intro to Quantifiers	II.9
October 26	Intro/Logic of Quantifiers	II.9/10
October 30	Logic of Quantifiers	II.10
November 2	Multiple Quantifiers	II.11
November 6	Multiple Quantifiers	II.11
November 9	Methods of Proof	II.12
November 13	Methods of Proof	II.12
November 16	Formal Proofs and Quantifiers	II.13
November 20	No Class (Thanksgiving)	
November 23	No Class (Thanksgiving)	
November 27	More About Quantifiers	II.14
November 30	Metatheory/Resolution	Glimpses @ III
December 4	The Paradoxes	III.15
December 7	The Paradoxes	handouts
December ?	**Takehome Final**	

5 Grading

There will be a midterm (25%) and a final (35%), both takehome, and both to be composed mostly of problems to be sent to and graded by "Grade Grinder." There will also be two homeworks, each worth 15%; in both cases you will be asked to solve at least one "robust" problem from *LPL*, with your work again submitted to and graded by "Grade Grinder." There is guaranteed to be at least one surprise quiz worth 10%. No notion of "resurrection" is built into the grading scheme. Please appeal grades by seeing me in person.

[1] Although see the "hosts" graphic at

- `http://www.rpi.edu/~brings/intai.html`

6 Academic Honesty

Student-teacher relationships are built on mutual respect and trust. Students must be able to trust that their teachers have made responsible decisions about the structure and content of the course, and that they're conscientiously making their best effort to help students learn. Teachers must be able to trust that students do their work conscientiously and honestly, making their best effort to learn. Acts that violate this mutual respect and trust undermine the educational process. They counteract and contradict our very reason for being at Rensselaer and will not be tolerated. Any student who engages in any form of academic dishonesty will receive an F in this course and will be reported to the Dean of Students for further disciplinary action. (The *Rensselaer Handbook* defines various forms of Academic Dishonesty and procedures for responding to them. All of these forms are violations of trust between students and teachers. Please familiarize yourself with this portion of the handbook.) *Please be advised, specifically, that this course puts a premium on work done on your own, outside of class, with this work submitted to Grade Grinder. While you can and will inevitably have general discussions with others about this work, this should be your own work, done in a file you created and finished. There can be no sharing of files. Such sharing is taken to constitute cheating. Grade Grinder is able to detect certain forms of cheating on these problems. Don't take any risks.*